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Waste Not, Want Not: Analyzing the Economic and Environmental Viability of Waste to Energy (WTE) Technology for Site-Specific Optimization of Renewable Energy Options

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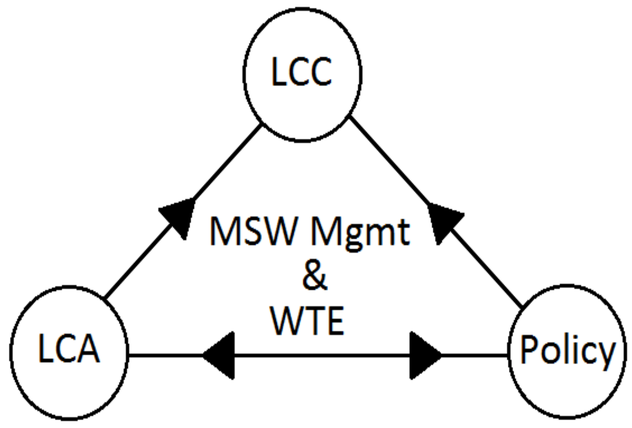
Project Description

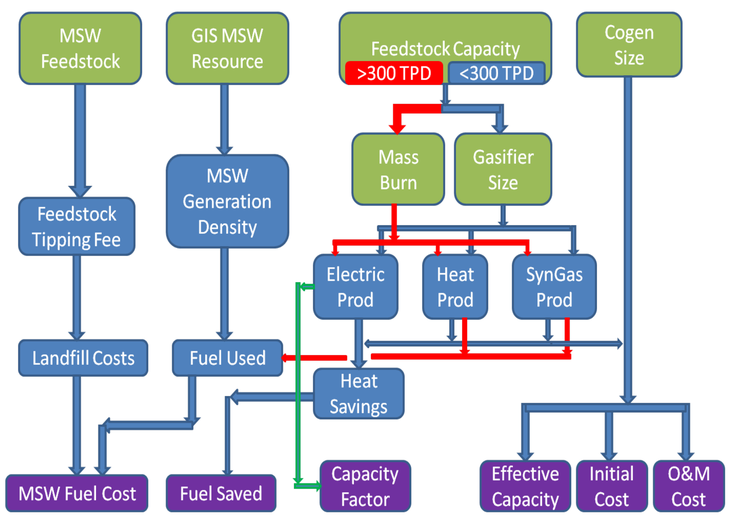
Modern waste-to-energy (WTE) technology burns municipal waste in an environmentally safe incinerator to generate electricity, provide district heat, and reduce the need for landfill disposal. While this technology has gained acceptance in Europe, it has seen little recent deployment in the United States. This study examined the environmental, policy, economic, and technical factors that have contributed to the success of the technology abroad, and considered how they might impact its adoption in the United States. A WTE modeling tool was developed to aid with planning WTE projects. The tool was used to analyze WTE as a candidate renewable energy technology on two sites. In addition, a separate WTE installation case study was conducted to analyze the environmental life cycle assessment (LCA) and policy constraints.



The WTE Analysis Tool

The WTE tool was developed as a spreadsheet model to analyze the energy production and economic feasibility of using MSW at a site. It uses a GIS dataset that aggregates available MSW available at a particular site to estimate the amount of energy available from MSW. The model incorporates various WTE technologies to help analyze the potential for a site.

WTE Module Flowchart



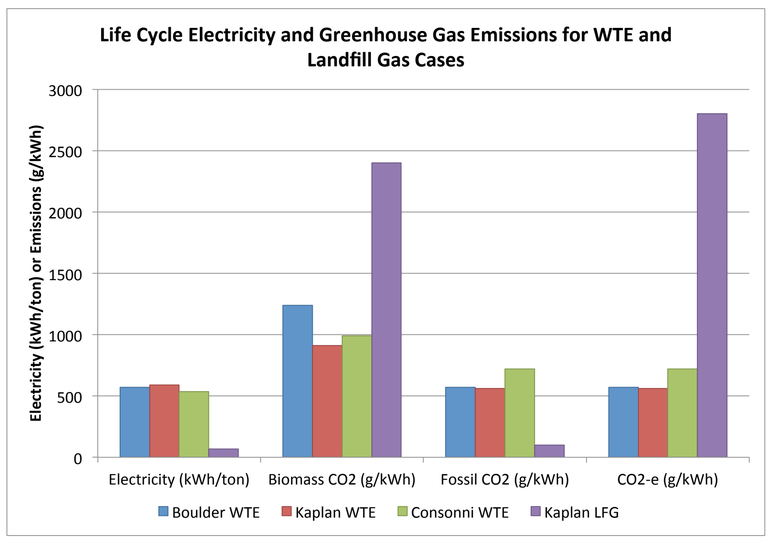
Using the WTE Tool

The WTE tool was utilized as a standalone tool to evaluate both WTE and biomass for the South Potomac Navy base, which included Dahlgren and Indian Head. The intention of the study was to use GIS data for available biomass and separately municipal solid waste, and correspond the conversion of these available feed stocks into electricity and compare the potential energy to the baseline energy usage on site. The tool was also used to perform an economic evaluation of each technology for potential savings to the bases. Among several scenarios, the projects with the highest potential savings were provided as recommended projects to perform the next level evaluation. Both Dahlgren and Indian Head had WTE projects which promised major savings over their current mode of operation.

LCA for WTE in Boulder, CO

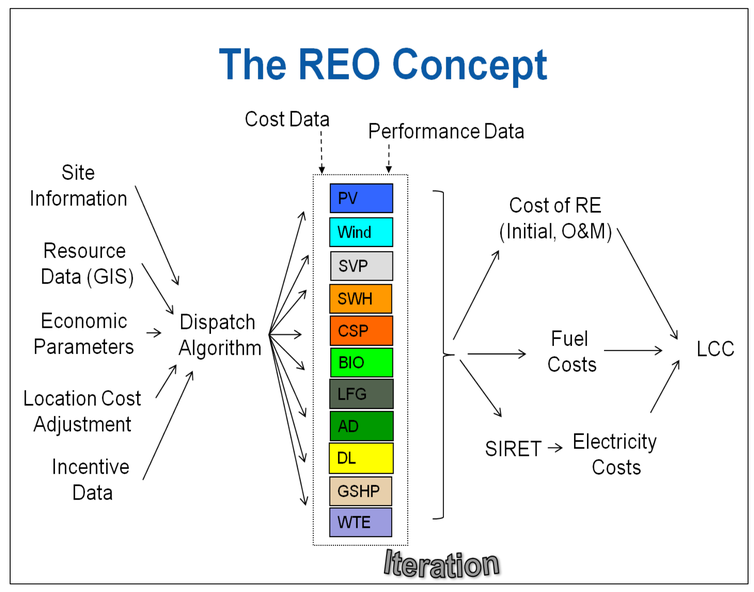
As part of this project, a life cycle assessment was completed using the U.S. Environmental Protection Agency's MSW-DST model for a hypothetical case study of using WTE to treat Boulder, CO's residual MSW. After recycling and composting diversions, the estimated quantity of residual MSW in Boulder was 78,000 tons per year. Compared to national average profiles, Boulder's residual MSW has relatively high fractions of food waste and low fractions of yard waste, glass, and metal. Despite these differences, LCA results for Boulder were similar to those from other recent studies that have examined similarly sized units.

As illustrated by the results from Kaplan et al. (2009) (below), LCA studies have generally suggested that MSW combustion is a better alternative than landfill disposal in terms of net energy impacts and CO_2-equivalent greenhouse gas emissions per unit electricity produced.



Future Work

Currently, the WTE tool is a stand-alone tool that enables analysts and engineers to consider WTE as a candidate renewable energy technology for a site. Future work will include integrating the WTE module into NREL's Renewable Energy Optimization (REO) tool. This will allow WTE to compete with the other renewable energy technologies such that the most cost-effective portfolio of renewable energy technologies can be determined.



References:
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